JPRS 79572

2 December 1981

# USSR Report

## CONSTRUCTION AND EQUIPMENT

No. 51

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# USSR REPORT

## CONSTRUCTION AND EQUIPMENT

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[III - USSR - 36a]

## IMPROVING MACHINE-BUILDING IN HEAVY EQUIPMENT

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 9, Sep 81 (signed to press 6 Aug 81) pp 12-21

[Article by N. Ryzhkov, first deputy chairman of the USSR Gosplan: "Machinery Quality and Material Resources"]

[Text] USSR Council of Ministers Chairman N. A. Tikhonov pointed out in the report to the 26th Party Congress that "increasing production efficiency in every way possible is the fundamental basis of modern economic development and the most important economic-political task of the present stage of building communism."[1] The primary role in the technical rearming of the national economy, in changing it over to an intensive path of development, belongs to machine building. It is rightfully considered one of the pivotal branches of the socialist economy and the foundation of technical progress.

Governed by V. I. Lenin's well-known thesis that a large-scale machine industry forms the material basis of socialism, our party and government have been tirelessly concerned about developing machine building. During the five-year plans, the country has created a powerful, multibranch machine-building industry capable of satisfying the most diverse demands of the national economy for modern tools of labor. The branch has been developed at outstripping rates from one five-year period to the next. Machine-building output now comprises 28 percent of all industrial output in the country.

During the 10th Five-Year Plan, production volume in machine building and metalworking increased 48 percent. The development of machine building continued at outstripping rates as compared with industry as a whole, which was anticipated by the resolutions of the 25th CPSU Congress. The production of such necessary types of output as powerful presses, single-purpose precision machine tools, excavators and bulldozers, automobiles, automation equipment, and others, increased significantly. Nuclear machine building, which is called upon to ensure rapid growth in power engineering in the country, was practically rebuilt entirely during the 10th Five-Year Plan.

The five-year plan assignments on producing machinery and equipment for stockraising and feed production, as well as the five-year plan assignments (for all years together) for producing and delivering equipment for agriculture, were fully met. The five-year plan was carried out in terms of automobiles, tractors and means of automation.

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[1]"Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, Izd-vo Politizdat, 1981, p 107.

The quality and structure of the machine-building output being produced has improved, substantial changes have been made in the designs of many types of machinery and equipment, unit capacity has been increased and specific metal- and energy-intensiveness have been reduced.

Unquestioned successes have thus been achieved in developing domestic machine building. At the same time, as was noted in materials of the 26th Party Congress and CPSU Plenums, there has been a certain lag in machine-building branches behind the needs of the economy.

Among the many questions of machine-building development which exert a substantial influence on the country's economy, we need to single out these as primary: problems of improving the quality of the machines being produced, lowering their materials- and energy-intensiveness and meeting the demand for machines and equipment in all branches of the national economy.

In spite of the successes achieved, questions of the quality of the output being produced, its progressiveness and competitiveness in the foreign market, have been and remain very pressing. A 1980 evaluation of the technical level of output produced by the ministries, covering about 20,000 items, which was made by commissions of the USSR State Committee for Science and Technology and USSR Gosplan showed that 29 percent of that output requires modernization or withdrawal from production.

The rates of utilization of new items are dropping. Output being utilized for the first time comprised 2.5 percent for machine building at the end of the last five-year plan, as against 4.3 percent in 1970. As a result, the proportion of obsolete machinery and equipment being produced by our industry remains high. Thus, the proportion of items which have been produced for upwards of 10 years increased from 20 percent in 1971 to 28 percent in 1980. The time involved in updating output is outside the economically substantiated limits, which retards improving the efficiency of all social production.

A certain lag has been observed in the technical levels of a number of types of output behind foreign analogs.

All this results from the fact that enterprises still do not have the necessary responsibility for promptly withdrawing obsolete equipment from production and the economic sanctions imposed on such enterprises are inadequate. Moreover, there are major shortcomings and deficiencies in the system of monitoring the technical level and quality of output being produced. Existing normative, legal and other guidance materials on monitoring and managing the updating of output and raising its technical level are frequently insufficiently interlinked and fail to ensure the economic interest of the producer and consumer in manufacturing and using new equipment.

Experience in certifying industrial output in the machine-building ministries by quality category has shown that the system now in use does not ensure that output is put into the correct quality category. Under the existing procedure, certification of machine-building output as being in the highest quality category is done by the state certification commission, which is comprised of representatives of the client, the State Standards Committee, Ministry of Foreign Trade and others. But the certification of output as being in the first and second categories is done by branch certification commissions. As a result, Category II has practically disappeared. The effort by enterprises to have their output certified as being in the

highest and first quality categories is encouraged by the fact that enterprise profit is reduced and in part transferred to the budget when output is certified as being in quality Category II.

The state of affairs with regard to the release of new machine-building output insistently demands radical changes in existing normative documents. This applies foremost to the system of product certification, monitoring the development, mastering and production of modern machines, and the prompt withdrawal of machines from production. The new normative documents must have a substantial impact on enterprise economic indicators. Plants producing progressive equipment should be encouraged for producing new, and often more labor-intensive output; they must have priority when determining the end results of the collective's activity.

Questions of the materials- and energy-intensiveness of machinery being produced are no less important.

As is known, one of the basic indicators of the progressiveness of machines and equipment is their reduced metal-intensiveness. In recent years, much work has been done along this line.

Take rail car building, for example. It is one of the most metal-intensive subbranches of heavy machine building. As a result of scientific research, design and experimental work done over the past 10 years, we have succeeded in lowering the mass of freight car support components by 20-25 percent and significantly increasing the corrosion-resistance of individual subassemblies and parts. The use of new types of steel for lining car walls and roofs has permitted a reduction in rolled metal expenditure of up to 200 kg per car because thinner sheet is used. All these steps have facilitated saving much scarce rolled metal.

The specific metal-intensiveness of certain types of lift-transport equipment, diesels and diesel generators, automobiles and tractors, excavators, metallurgical equipment, and so forth, has been reduced.

At the same time, a number of examples could be given of our equipment's being unjustifiably heavy. Several domestic forging-pressing machines and individual models of automobiles and tractors, tank cars, equipment for light and food industry, diesel motors, and so on, are heavier than foreign analogs.

The poor economy of a number of machines being produced is a negative factor in machine building. A significant portion of the equipment consumes an unjustifiably large amount of fuel and electric power.

Fuel and oil expenditure per unit of power is high in a majority of the internal combustion engines. In this regard, the experience of other countries deserves attention.

Losses of electricity in electrometallurgy and aluminum industry are still high due to imperfections in machinery and equipment being produced by enterprises of the machine-building ministries. Considerable heat reserves remain unused in chemical industry, housing and municipal services.

The development of more economic machines, installations and equipment would facilitate saving fuel and electricity. Thus, providing 65 percent of the trucks and 20

percent of the passenger cars with diesel motors would permit a reduction in the country's yearly expenditure of conventional fuel of approximately 10 million tons.

The metals- and energy-intensiveness of equipment depends basically on the machine's creator, the designer. In designing a machine, the designer must find an optimum resolution which corresponds to the basic purpose of the mechanism and which meets the requirement of maximum raw material and energy savings. At the same time, designers developing technically improved machines and devices rightly base their developments on the use of modern, progressive materials and assembly components. Such an approach sometimes leads to difficulties in the initial stage of production, but at the same time, it facilitates improving the quality of the initial materials and technical progress as a whole.

As is known, the basic task of machine building is to meet the demands of the national economy for means of production. Much has been done in this area. Practically all the national economy's requirements for large-scale power engineering and electrothermal equipment, certain types of trucks, many types of agricultural equipment and other machines are being met.

However, as before, there are difficulties in providing the national economy with rolling, chemical, lift-transport equipment, mechanized building tools, special metalworking equipment, individual types of highly productive construction vehicles, and especially equipment for food and light industries. The national economy is being provided with 80-85 percent of this equipment.

In recent years, serious lag has been noted in meeting the rapidly growing needs of mining branches of industry for heavy mining-transport equipment. The reason is that, for a long time now, the Cheboksary Heavy-Duty Tractor Plant has not been able to develop the base model for a 330-h.p. industrial tractor. The existing model is relatively unreliable, uses a great deal of metal, and so forth. As a result, mining industry has heretofore not had a domestically-produced heavy-duty bulldozer. Series production of 110- and 180-ton dump trucks is lagging, and the 75-ton dump trucks being manufactured, in small quantities, have specifications inferior to those of the best foreign models. Few 12.5- and 20-$m^3$ scoop back hoes are being released. Mining industry is also not being supplied with SBSh-320 drills and other equipment. It is basically for the indicated reasons that enterprises of the USSR Ministry of Ferrous Metallurgy have underfulfilled the stripping assignment by 250 million cubic meters this past five-year plan. That cannot but have an effect on work in the branch.

Problems of providing the national economy with diesels, lead batteries and cable items have not been solved.

Big tasks have been set machine building by the 26th CPSU Congress. L. I. Brezhnev's report at the congress noted: "Machine building is called upon to master without delay and embody in highly efficient, reliable machines, devices and flow lines advancements created by scientific and engineering thought."[1]

This high evaluation of the role of machine building in the technical rearmament of the country imposes a special responsibility on machine builders. In the 11th Five-

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[1]"Materialy XXVI s"yezda KPSS," p 44.

Year Plan, the release of machine-building and metalworking output will increase at least 1.4-fold. At the same time, its structure will become more flexible and receptive to technical innovations and discoveries, more capable of introducing genuinely revolutionary changes into production.

Our economy's turn towards an intensive path of development faces machine building in the 11th Five-Year Plan and the long-range perspective with a most important task, that of ensuring the fundamental rearming of all branches of the national economy on a base of introducing highly productive energy- and materials-conserving machines, equipment and devices. Questions of saving materials, fuel and energy resources must take precedence. In the current five-year plan alone, the savings in fuel and energy resources in the national economy will be 160-170 million tons of conventional fuel.

Another equally important task facing machine builders due to the current unfavorable demographic situation in the country is the development of means of automating and mechanizing production to develop all spheres of the national economy without enlisting additional labor resources. We plan to hypothetically free from 10 to 12 million workers for other jobs in the country in the 11th Five-Year Plan by carrying out these measures.

Machine building is also entrusted with resolving a number of major social tasks connected with profound transformations in the most important sphere of people's activity, labor; these measures will be aimed at making labor easier and improving working conditions.

All machine-building assignments stemming from the resolutions of the 26th Congress are outlined in the draft five-year plan of social and economic development. Thus, the proportion of output in the highest quality category is to be increased approximately 1.4-fold. Equipment productivity is to increase 1.3- to 1.5-fold, and to two- to 2.5-fold in a number of instances.

Much work will be done in machine building to equip machines and equipment with hydraulic, pneumatic and electric drives and built-in microprocessors. These lines will permit a sharp rise in the technical level of a majority of the machines. We anticipate further development and expansion of the machine systems and complexes, higher unit capacities and the development of robot-manipulator production.

Each branch of machine building is faced with its own complex, diverse problems associated with better meeting the national economy's demands for modern equipment. Growth in the production of output in power machine building, machine tool building, automation devices, machines for stockraising and feed production and agricultural machine building will outstrip growth in machine building production as a whole.

The Ministry of Machine Building for Heavy Industry Enterprises is faced with resolving serious tasks involving increasing the production of rail transport rolling stock and heavy-duty mining equipment; the Ministry of Chemical and Petroleum Machine Building and other ministries -- providing gas pipeline construction with equipment, including equipment to operate at pressures of 100 atm, and with retooling drilling; Ministry of Automotive Industry -- providing the vehicle fleet with diesel motors and producing means for mechanizing loading, unloading and warehousing work, and so forth. Other branches of machine building are also faced with equally important tasks.

The quality of the machines and equipment being produced and full use of existing capacities depend largely on providing machine builders with material resources, and foremost with structural materials. More than a third of the rolled metal being produced in the country, upwards of 40 percent of the sheet iron, two-thirds of the sheet steel and upwards of 60 percent of the ingot- and drop-forged pieces go to manufacturing machines and equipment. The consumption of rolled ferrous metals in machine building and metalworking is constantly increasing. Thus, whereas these branches were supplied with 26 million tons of rolled metal in 1970, the figure was 34 million tons in 1980.

Questions of using such a large amount of metal economically must be top-priority items in the operation of the machine-building branches. The 11th Five-Year Plan assignments for machine building and metalworking anticipate an average reduction of 18-20 percent in the norms of ferrous rolled metal expenditure. The factoral structure of this reduction, with consideration of progressive trends in the development of ferrous metallurgy and other branches of industry, is characterized by the following data:

| | million tons | percent |
|---|---|---|
| reduction in rolled ferrous metals economy and expenditure norms, total | 8.4 - 9.3 | 18 -20 |
| including: | | |
| use of better-quality rolled metal and economical shapes | 2.3 - 2.8 | 5 -6 |
| use of rolled-metal substitutes | 0.65- 0.90 | 1.4-2 |
| introduction of progressive technological processes | 2.75- 2.8 | 5.9-6 |
| improved machine and equipment designs | 2.65- 2.8 | 5.7-6 |

In this regard, about 62 percent of the savings must be provided by technological measures aimed at raising the use factor and lowering specific losses and scrap for rolled metal and by improving machine design, and the remainder must be provided by the use of more progressive materials.

Saving rolled metal in machine building depends to a considerable extent on the quality of ferrous metallurgy output. Carrying out the steps planned for 1981-1985 to increase production efficiency and the use of metal products made of ferrous metals will enable us to save about seven million tons of metal output in the national economy, including more than 2.4 million tons in machine building and metalworking. Deliveries of low-alloy steels to machine building will be increased 2.4-fold, of heat-treated rolled metal -- three-fold, of curved and new section shapes -- 0.6- and 2.7-fold, respectively, and so forth.

The quality of rolled metal as a whole is improving from one five-year plan to the next. The proportion of cold-rolled sheet, rolled metal products made of low-alloy and alloy steel, cold-bent shaped and other economic types of rolled metal is increasing. Therefore, machinebuilders should, as the main consumers of metal, pay particular attention to its intelligent, economical use. Unfortunately, in a number of instances, the use factor for high-quality rolled metal is low due to the poor technological effectiveness of parts and low level of metalworking technology, in the production of blanks in particular. Improving the quality of rolled metal and increasing its strength requires consideration of these factors, first of all by designers when they develop machines and equipment, with a view towards achieving the maximum possible savings of metal.

The proposal by the Institute of Arc Welding imeni Ye. O. Paton that rolled ferrous metals differentiated in terms of strength be introduced into industry, including machine building, deserves attention. It is known that rolled ferrous metals are dissimilar in terms of mechanical properties. Up to 90 percent of all rolled ferrous metal being produced in the most widely used brands of steel have strengths considerably above those set in the standards. This makes it harder to design the machines. An analysis made by the institute shows that not more than two percent of the certified rolled metal is at the normative strength set by the minimum strength specifications. As a result, up to 30 percent of the strength of rolled carbon steel and up to 20 percent of the strength of low-alloy steel is unused.

Differentiating rolled steel by groups with different levels of strength is of great national economic importance, which is confirmed by an analysis of the operation of several of the country's metallurgical plants in terms of their release of rolled carbon and low-alloy steel differentiated into two strength groups.

It turned out that rolled metal differentiation led to the isolation of about 40 percent of all the steel as exceeding the tensile strength limit by 20 percent. Use of this rolled metal would permit reducing metal consumption by an average of 17 percent, in which connection the specific metal-intensiveness of power elements could be reduced by about 25 percent.

Rolled metal strength differentiation could be done practically without increasing raw material, labor or energy resources. Net cost would increase by only 1.5 percent were rolled metal to be divided into two groups. Changing over to the extensive use of rolled ferrous metals differentiated into two strength levels would require:

reworking existing norms and rules for designing machines (the principles on which they are built were formulated in the mid-1950's and do not reflect the scientific and technical achievements of recent years);

broadening the technical conditions for producing differentiated rolled metal, with changes in the necessary All-Union State Standards;

stimulating the production and consumption of this progressive rolled metal.

Steps to differentiate rolled metal must occupy a leading place in work on saving metal in this country.

One promising direction in which metal expenditures in machine building could be reduced is the use of high-strength steels. Low-alloy steels with a tensile strength of 35-40 $kgf/mm^2$ no longer satisfy machine designers. In the early 1950's, work on developing stronger and high-strength low-alloy steels was expanded in many countries. The USA now produces more than 25 brands of high-strength steel with tensile strengths of 60-90 $kgf/mm^2$ in a broad assortment of thicknesses. Japanese industry produces upwards of 30 brands of high-alloy heat-hardened steel.

Modern high-strength, low-alloy, heat-treated steels have tensile strengths of up to 100 $kgf/mm^2$ and possess good weldability and plastic resistance to corrosion and satisfactory machinability. They are used to manufacture high-load welded machine-building components. Their use in all instances ensures smaller components, greater reliability of operation and better durability of the machines and mechanisms.

In many cases, high-strength steels enable us to develop fundamentally new, high unit-capacity machines which could not be developed based on the traditional steels.

They include: 75-, 120- and 180-ton vehicles; rail carrier for freight exceeding 400 tons; walking excavators with 80-100 $m^3$ buckets; 160- and 250-ton truck cranes; roadbuilding vehicles; powerful crane equipment; 200-500 meter bridge span components and many other machines needed by the country's national economy.

The use of high-strength steel provides an opportunity to reduce the size of welded components by 25-40 percent and reduce its net cost 15-20 percent as compared with components made from low-carbon steel. The reliability of operation of such components a low temperatures is substantially higher. However, our metallurgical industry is not yet meeting the growing demands of machine building for such steels.

Another, and equally important, direction in which metal consumption is being reduced in machine building is to replace it with more economical types of structural materials. The theoretical, technological-design and economic aspects of this problem have been worked out in considerable depth. But in practical activity, their proportion of the total reduction in metal expenditure in machine building is in last place. This is to be explained by the scarcity of substitutes (in spite of the fact that priority is given to their production).

The present level of development of all branches of machine building and tool making results in the necessity of using new polymer structural materials. The rapid growth in the production of structural plastics is a characteristic phenomenon in all the technically developed countries of the world. In machine building, a large part of the polymers is used to manufacture critical parts and subassemblies of machines, mechanisms and devices. One kilogram of these materials replaces 4-5 kg of rolled ferrous metals. It requires an average of 540 man-hours less time to produce one ton of plastic products than to produce a similar amount of metal parts, and two- to three-fold less energy is required.

This past five-year plan, the Ministry of Chemical Industry, jointly with scientific institutes, did considerable work on developing new structural polymers. Machine-building branches consume each year more than 750,000 tons of plastics and synthetic resins, upwards of 90 percent of which is used as structural materials. The largest consumer of these materials is electrical engineering industry. More than 150,000 tons of plastics each year goes into the production of automobiles and household electrical appliances and about 70,000 tons goes into producing verious devices and means of automation. The savings from using one ton of plastic averages 1,300 rubles, and over 3,000 rubles in tool building and electrical engineering.

Thanks to the scientific-production potential created in chemical industry, in the 11th Five-Year Plan, we will begin producing new structural polymer materials with high heat resistance and dialectric strength. Plastics with dispersion or fibrous fillers, as well as gas-filled materials manufactured using various polymers, are acquiring particular importance to further progress in machine building. In view of the great economic effectiveness of using plastics, first of all in machine building, we plan to increase their production 1.7-fold, including a 2.2-fold increase in polyethylene production.

It is the task of machine builders to use available resources intelligently, directing them into the more economical manufacture of machine parts and subassemblies. The training of skilled designer personnel to design items using plastics, technologists and materials specialists for processing them, is of not inconsiderable importance.

According to USSR Central Statistical Administration data, metal scrap will continue to increase in machine building and metalworking. Thus, machine-building production generated 16.9 million tons of ferrous metal scrap in 1980, including 7.9 million tons of cuttings. Scrap accounted for 20.8 percent of the metal consumed. In this regard, the proportion of scrap even increased by 0.2 percent during the 10th Five-Year Plan, although the proportion of cuttings in the total amount of metal consumed decreased appreciably (from 14.7 percent in 1975 to 9.7 percent in 1980). The proportion of ferrous metal scrap was above the national economic average at enterprises of the Ministry of Electrical Engineering Industry, Ministry of Machine Tool Industry, Ministry of Automotive Industry, and others. This situation concerning ferrous metal scrap results from the structure of procurements and the availability of equipment at enterprises, especially in the production of blanks.

Changes in the structure of procurements in machine building and metalworking are described by the following data (in percent):

| | 1975 | 1980 |
|---|---|---|
| welded metal components | 48.3 | 50.0 |
| stampings (hot) | 8.0 | 8.2 |
| pieces forged from ingots | 2.1 | 2.1 |
| castings | 41.6 | 39.7 |
| including: | | |
| iron | 30.0 | 28.28 |
| steel | 9.7 | 9.3 |
| nonferrous | 1.9 | 2.07 |
| items made from metal powders (excluding items obtained by rolling) | -- | 0.05 |

It is evident from these data that almost half the procurement uses castings and pieces forged from ingots. Inasmuch as the coefficient of blank use here is 0.65 and 0.86, respectively, the conclusion can be drawn that the bulk of the cuttings occurs when processing blanks produced by this method.

The current structure of procurements in machine building is a result of an economic and technical policy carried out over a long period of time. The enormous scale of production makes it hard to reorient blank production quickly although, as is evident from the above data, this process is occurring.

These tasks can be resolved with consideration of a structural shift in metalworking equipment in machine building. The famous decree on developing the country's machine tool building anticipated change in the relationships between the production of machine tools and forging-pressing machines in favor of the latter.

In the 11th Five-Year Plan, we have outlined the priority production of modern forging and pressing equipment. Some 220,000 improved forging-pressing machines will be manufactured. Their proportion of all machine-tool production will increase from 21 percent in 1980 to 24 percent in 1985. This will ensure that existing bland production facilities of our enterprises will be re-equipped with more modern units permitting the release of blanks close to the shape of the future parts.

It is the task of the country's machine tool builders and the consumers of the equipment they produce to jointly solve the technical problems determining the level of

progressiveness and technical-economic effectiveness. In this regard, the experience of enterprises of the Ministry of Automotive Industry and Ministry of Machine Tool Industry deserves attention.

Capacities to produce 100,000 stampings for automobiles are being created at the ZIL production association's Ryazan' Automotive Units Plant. For the first time in domestic practice, technological processes for hot stamping are being worked out jointly with the main supplier of forging-pressing equipment, Voronezh Association to Produce Heavy-Duty Machine Presses. The extensive use of domestic automated equipment and progressive technological processes at this plant enables us to save more than 11,000 tons of hot-rolled metal and to create favorable working conditions. The metal use coefficient has risen from 0.795 to 0.83 and the output per worker -- from 126 to 157 tons, as compared with the most progressive forging production in our country, that at KamAZ [Kama Automotive Plant].

The reduction in metal expenditure in cast steel and iron must occur primarily due to a reduction in ingot size and a planned reduction in the production of uneconomical cast blanks. In 1980, our country produced six million tons of cast steel, comprising nearly six percent of the finished rolled metal, and spent about 10 million tons of molten steel on it. In Japan, the FRG, Italy and France, cast steel comprises less than one percent of all finished rolled metal, and in the USA -- 1.79 percent.

As distinct from other types of blanks, castings can be replaced with welded components in machine building. Work here in this area is proceeding in a planned manner. The volume of welded components produced in industry is to increase to 53 million tons in 1985, which is 1.2-fold more than the 1980 level. Their production will be increased faster than the production of steel, rolled and cast metal.

Thus, whereas in 1980 the total volume of welded components used to replace cast and forged blanks was 26,000 tons for five machine-building ministries, we plan to replace about 400,000 uneconomical types of castings and forgings in 1981-1985. Implementation of these measures will ensure, in addition to improvement in the weight specifications of much machinery and equipment, a significant economic impact.

For example, we anticipate replacing upwards of 100,000 tons of uneconomical types of blanks, about 87 percent of which are accounted for by cast steel and 12 percent by pieces forged from ingots, in transport machine building and machine building for heavy industry enterprises in the current five-year period. In this regard, the economic impact will be approximately 80 million rubles. In machine tool building, it will be possible to replace upwards of 120,000 uneconomical types of castings and pieces forged from ingots in 1981-1985, primarily in the production of forging-pressing equipment and in the manufacture of base parts for large machine tools. The economic impact will exceed 79 million rubles.

Reserves for saving metal by improving the technology and structure of blanks and reducing scrap are enormous here. The extremely slow increase in the metal use factor in machine building is to be explained by the lack of a planning principle in this work. Prior to 1980, the metal use factor was not planned and was taken into account only "optionally." This situation could naturally not produce positive results. The draft five-year plan anticipates an increase in the rolled metal use factor in machine building to 0.78-0.79 in 1985, meaning a 32- to 35-percent reduction in losses and scrap as against the 1980 level.

Much metal can be saved by reducing the metals-intensiveness of machines and equipment. The country's leading enterprises have achieved substantial results in this area. Thus, Uralmashzavod anticipates reducing specific metal consumption in the following machines in the 11th Five-Year Plan:

| | 1981 | 1985 |
|---|---|---|
| excavator, tons/cubic meter: | | |
| ESh-20/90 | 106.5 | 85 |
| KEG-5A | 34 | 31.6 |
| 50,000 ton-force stamp, kg/ton-force | 203 | 187 |
| blast furnace iron-notch gun, $t/kg/cm^2$ | 0.35 | 0.27 |
| AKM-650 sintering machine, t/t/hr | 5.75 | 5.62 |
| OK-520 roaster, $t/m^2$ | 12.1 | 8.4 |
| MShR 2100 x 3000 ball mill, $t/m^2$ | 5.35 | 4.0 |

These data testify to the presence of major reserves, as is confirmed by numerous examples of our equipment's being unjustifiably large. In the 11th Five-Year Plan, machinery and equipment metal-intensiveness will be reduced by an average of 12-15 percent. The bulk of the savings in ferrous metals in machine building will be obtained in this way.

The efficient use of metal is a multifaceted question. Its resolution must have many aspects, one of which will be improved planning. The USSR Gosplan is improving its work on introducing progressive norms and normatives into planning and a system of new planning indicators is being introduced. The expenditure norms approved by the ministries are somewhat inflated and do not reflect how progressive technological processes are. Actual reporting on material resources consumption generally does not coincide with the norms planned by the ministries. The USSR Gosplan, jointly with the ministries, must do much more work on its choice of measures for physical indicators which will reflect to the maximum the consumer properties of the output.

The CPSU Central Committee and USSR Council of Ministers recently adopted a decree "On Intensifying Work on Saving Raw Material, Fuel-Energy and Other Material Resources and Using Them Efficiently." It reflects the fundamental questions of using material resources efficiently in the country. This most important document of the five-year plan will doubtless play a large role in the continued advance of our country's economy.



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CSO: 1821/015

UDC 338.45:666.94

CEMENT INDUSTRY DURING ELEVENTH FIVE-YEAR PLAN

Leningrad TSEMENT in Russian No 3, Mar 81 (signed to press 23 Feb 81) pp 2-4

/Article by V. I. Kushchidi, deputy minister of the USSR Ministry of the Building Materials Industry: "Cement Industry's Tasks during the 11th Five-Year Plan"*; passages enclosed in slantlines printed in boldface/

/Text/ The 26th Congress of the CPSU summed up the results of the Soviet people's work during the 10th Five-Year Plan and approved the "Basic Directions of the USSR's Economic and Social Development for the Years 1981--1985 and for the Period until 1990."

This profoundly scientific, universally developed, and well-grounded Party document has outlined the grand plans for building communism, and it has specified the paths for the further upswing of the country's economy and the growth of the Soviet people's prosperity. It also contains a specific assignment for the cement industry: "In 1985 produce as much as 140--142 million tons of cement. Expand the output of high-type and specialized cements."

In connection with this, we must examine the principal tasks for the development of our sector during the 11th Five-Year Plan.

/Growth of cement production/. Cement output at the enterprises of the USSR Ministry of the Building Materials Industry should comprise 130 million tons by 1985, i. e., a 12.9 percent increase over 1980, which exceeds the planned level of the builders' needs for binding materials for this period.

One important reserve for increasing cement output is developing the design capacity of existing enterprises. This is all the more urgent in that during the 10th Five-Year Plan there was a reduction in the coefficient of use of the kilns, and their above-plan idle times increased. There was also a delay in the development of high-capacity technical lines using the dry method of production with kilns 6.4 × 95 m in size.

As a result of building new enterprises, as well as expanding and modernizing existing ones, cement production should increase by 13.7 million tons, including

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* See also V. I. Kushchidi's article, "A Precise Rhythm of Operation for the Cement Industry," TSEMENT, 1981, No 2.

a 3.9-million-ton increase by means of process intensification and plant re-tooling. Hence, the most constant attention of Party committees and enterprise managers must be devoted to ensuring the growth of capacities.

During the 11th Five-Year Plan development will be continued on the dry method of production. By the end of the five-year plan cement output by this method should amount to at least 22 million tons, which will allow us to save about 300,000 tons of conventional fuel.

Development of the dry method of production will proceed along the following basic lines:

construction of new technical lines with reactor-decarbonizers having a capacity of 3,000 tons per day and more;

completion of construction already begun and putting into operation of new technical lines with kilns having dimensions of 7/6.4 x 95 m;

modernization of existing rotary kilns for the dry method of production by means of supplying them with decarbonizers and automatic equipment.

At a number of enterprises we must improve technological discipline and reduce the breakdown rate of equipment, as well as reduce the idle times of kilns spent on major and medium repairs, along with lining operations.

Increasing the reliability of the cement equipment and spare parts depends on the machine-builders and enterprises of Glavremmekh /Main Administration for Repair and Mechanization/. Therefore, cement workers hope that during the 11th Five-Year Plan there will be considerable improvement in the quality of the following items being delivered: casing shells, belts, roller bearings, and rim-drive gears of kilns, heat-exchange circuits, grate coolers, mill drums and drives, reinforced linings, interchamber baffles, and other parts, which will also facilitate the increase of cement output.

This sector has quite a few examples of good work by enterprises which have achieved high production indicators; they have successfully mastered and exceeded the design capacities of the equipment used by them.

Thus, the group at the Angarskiy Cement and Mining Combine, the initiator of the All-Union socialist competition for the culminating year of the 10th Five-Year Plan, was one of the first, on 18 November 1980, to fulfill the five-year assignment for cement production. It produced 142,000 tons of binding material above the plan quota. The increase of cement output during the five-year plan, as compared to 1971--1975, using the same production capacities, amounted to 763,000 tons. Output totalling 4.4 million rubles worth was sold in addition to the plan amount. Moreover, significant savings were achieved in raw materials, fuel, and energy resources. The expenditure of conventional fuel to roast one ton of clinker at this combine is the lowest throughout the entire country's cement industry. Labor productivity during the five-year period increased by 24.9 percent. For its high labor indicators the combine's group was placed on the All-Union Board of Honor of the USSR VDNKh /Exhibition of USSR National Economic Achievements/.

Despite the complexity of securing transport, the group at the Serebryakovskiy Cement Plant was successful in fulfilling the 1980 plan, the tasks of the five-year plan, and its socialist pledges, having provided the country with more than 3 million tons of high-quality cement.

The group at the Voskresensktsement PO /Production Association/ gave a good account of themselves in coping with the fulfillment of the five-year plan. Production output during the years 1976--1980 in comparison with the 9th Five-Year Plan increased by 452,000 tons, while the volume of its sales went up by 9.5 million rubles; this was achieved by means of implementing a complex of measures with respect to the retooling of production: modernization of three rotary kilns, replacement of five raw-material and cement mills by more highly productive ones, and the introduction of effective dust-catching apparatus.

Along with these foremost enterprises, the sector has a large group of steadily working plants which are successfully coping with the plan assignments. Under the conditions of limitations placed on the supplies of fuel and electric power, as well as limitations on the material and technical provisions at these plants, they found and successfully implemented new methods of production management. But at the lagging and insufficiently organized enterprises under these conditions shortcomings in production work have manifested themselves and become intensified.

/Capital investments and the introduction of new capacities/. The construction projects of the cement industry during the 11th Five-Year Plan must assimilate approximately 1 billion rubles of capital investments, which is 11 percent more than was assimilated during the 10th Five-Year Plan.

Provision has been made to put into operation new technical lines using the dry method of production at the Krivoy Rog and Nev'yansk Cement Plants (1984), equipped with cyclone-type heat-exchangers and decarbonizers.

Furthermore, technical lines using the dry method of production with kilns measuring $6.4 \times 95$ m are scheduled to be put into operation at the Navoysk, Rezinsk, and Novokaragandinsk Plants.

Enterprises under construction as well as those being expanded must begin ahead of time the training of skilled operational personnel, taking into account the progessive experience in mastering high-capacity technical lines using the dry method of production at the Novospassk Cement Plant, as well as ensure the most expeditious construction of housing and create good everyday living conditions for the personnel of these enterprises.

The quarries of a number of cement plants had already during the 10th Five-Year Plan exhausted their supplies of carbonate or clay-type raw materials. It is necessary, therefore, in the very near future to put into operation new quarries and renovate old ones; approximately 16 percent of the capital investments throughout the sector will be directed at this task.

In order to eliminate shortcomings in the work of raw-material redistribution of existing plants, we must replace, modernize, or expand grinding workshops with the installation of 49 mills, 36 crushers, and more than 50 compressors.

/Assortment and quality of cement/. During the past five-year plan there was a significant expansion in the production of effective types of cements, and their quality was improved.

The proportion of portland cement throughout the enterprises of the USSR Ministry of Building Materials Industry increased from 64.9 percent to 68.2 percent, the output of rapid-hardening portland cement grew by 17 percent, decorative cement--by 54.2 percent, pre-stressed by 54.8 percent, and high-strength cement--by a four fold factor.

The average brand of cement increased from 39.9 MPa (1975) to 40.7 MPa (1980), which is equivalent to an additional output of 3 million tons of cement.

During the 10th Five-Year Plan the proportion of higher-quality cements increased from 6.0 to 24 percent. At the present time 120 brand-types of cement in the higher category have been certified at 60 enterprises.

Improvement in the cement quality has been facilitated by the introduction at 20 plants of a comprehensive system of production quality control (KSUKP), as well as developing and partially introducing it at the remaining enterprises.

At the present time our sector is producing cement in a wide variety of types and is fully ensuring the needs of capital construction.

The existing practice of systematically raising the plan average brand of cement inevitably leads to an increase in the specific outlay of fuel and electric power, and it also requires additional capital investments, since the growth of the average brand is achieved primarily by means of curtailing the optimum level of producing the brand-300 cement and reducing the introduction of additives. Therefore, we must switch to planning cement output in an assortment whereby its average brand must be stabilized at the existing level.

The principal tasks with regard to raising the quality and improving the assortment of cement, taking into consideration the ensuring of maximum savings on fuel and energy resources are as follows:

bringing the production of cement with the State Badge of Quality by the end of the 11th Five-Year Plan up to 34 percent of the total output;

very rapid development of the production of Brand-500 and higher cement in the regions of the Urals, Siberia, and the Far East, with an increase of its output by 2 million tons throughout the country during the five-year plan;

further expansion of the production of special cements, with an increase in the output of sulfate-resistant and decorative cements by 30 percent and grouting cement by a factor of 1.5;

increasing and dispersing throughout the territory of the USSR the production of laying (small-clinker) cements (containing 30--50 percent of clinker and 50--70 percent of local additives), which can be successfully utilized for plastering and laying operations, as well as in the production of low-brand concretes;

developing on a new technological basis high-strength and very-rapid-hardening cements, which will allow us to refrain from the heat treatment of reinforced-concrete products or to substantially reduce the length of time required for this process;

organizing the production of high-strength cement, with the use of crystallization components--fasteners, as a result of which there is a significant reduction in the expenditure of fuel and electric power, as well as the outlay of binder in its use;

expanding the output of pre-stressed cement, with improved properties and with lower outlays for its production;

development of the production of cement, using new super-softeners obtained on the basis of modified calcium lignosulfates, as well as with new surface-active substances, which will allow us to save on fuel, electric power, and materials.

/Labor productivity and retooling of enterprises/. The five-year plan immediately before us will be characterized by a complication of the demographic situation and a reduction of labor resources in the country. Hence, the planned increase of cement production must be achieved basically by means of raising labor productivity.

In order to bring this about, it is necessary to implement the following measures:

sharply raise the level of utilizing existing capacities;

speed up the introduction into operation of new, highly productive units, the retooling of enterprises and the modernization of existing equipment, as well as taking out of operation obsolete and poorly productive units;

considerably raise the level of mechanization of repair work, auxiliary, and freight-handling operations, where 70 percent of this sector's workers are still employed;

the sectorial institutes, headed up by NIItsement /Scientific Research Institute for Cement/, must expedite the development of a comprehensive program with regard to creating machinery and equipment to replace manual labor on all production divisions, as well as at subsidiary and auxiliary operations;

expedite the implementation of automated control of technological processes at various production points;

introduce on a broader basis the new forms of labor organization and socialist competition, disseminate the experience of progressive groups and the best production workers, improve the moral and material incentives for labor achievements;

continually improve the social, everyday, and cultural conditions of the cement workers' lives, and curtail the turnover of personnel.

During the past five-year plan the sector's scientific-research and planning institutes created a considerable stockpile of projects regarding the development of technical processes which are new in principle. The following should be relegated to this category: obtaining high-strength and stress-type cements using fastening agents, experimental production of alinite cement by means of low-temperature, saline technology at the Akhangaransk Combine, and others.

All this will allow us to proceed during the 11th Five-Year Plan to the broad-based introduction of new technologies, to create units engaged in turning out sulfoalumosilicate components (fasteners) at the Amvrosiyevsk Combine, sulfoaluminate clinker (SAK) at the Mikhaylovtsement PO and at the Sukholozhsktsement Combine, as well as calcined /roasted/ alunite at the Kaspsk Plant.

Provisions have been made to organize the production of high-strength cements in an amount of 600,000 tons, utilizing LSTM-2 super-softener, the introduction of closed-cycle cement grinding at 15 mills, efficient heat-exchanging apparatus of kilns and concrete blocks with protective cast-iron plates for their linings, the broad-based use of intensifiers for concrete grinding, the use of rolled-type, reinforced linings at 150 cement mills, and a number of other measures.

/Savings on fuel, energy, and material resources/. An extremely important task for the cement industry is the maximum reduction of the expenditures of fuel and energy resources. In order to reduce the energy outlays on the production of cement, to impart special technical properties to it, and to increase production efficiency in this sector, mineral additives are being widely used; this corresponds to the worldwide trend toward increasing the production and use of mixed-type cements, as well as toward the significant reduction in the output of fuel-consuming, pure-clinker cements.

For the purpose of curtailing the outlays of raw-material, fuel, and energy resources, we must utilize the maximum amount of waste-products from other sectors of industry as raw-material components, active and inert additives to the cement (granulated slags, phosphogypsum, ash and slag from TETs's, waste products from aluminum production, etc.).

Operational experience of the Sukholozhsktsement and Novorostsement Combines, the Akmyantsementas and Spassktsement PO's, the Gornozavodsk, Savinsk, Katav-Ivanovsk, Topkinsk, and other plants, which in 1980 achieved the best indicators with regard to reducing the specific expenditure of fuel and electric power, indicate that the reserves along these lines are inexhaustible. They include the following: introduction of efficient heat-exchange and combustion equipment, modernization and supplementary feeding of slag to the kilns, modernization of raw-material and cement mills, replacement of pneumatic-screw pumps with pneumatic-chamber ones, use of highly productive turbo-compressors and combined loading of mills with grinding bodies, use of wear-resistant resin for the lining of raw-material mills, changing mixes by self-grinding mills, etc.

The 11th Five-Year Plan contains a plan provision for lowering the specific outlay of fuel for calcining clinker by from 225 to 219.3 kg. throughout the sector as a whole.

This is a difficult task, but one which is within our capabilities. It ought to be solved by means of the complete development of existing technical lines and the putting into operation of new ones using the dry method of production, attaining the plan indicators for the technical lines using the wet method with kilns measuring 5.0 ×185 m, modernizing or taking out of operation obsolete, poorly productive kilns, intensifying the grinding processes with the aid of surface-active substances (PAV) and improving technological discipline, as well as sharply curtailing the non-plan stoppages and burn-outs of kiln units due to equipment breakdowns and limitations in supplying the enterprises with electric power and fuel.

/Environmental protection/. During the 10th Five-Year Plan the cement industry conducted major operations on improving dust removal from production processes.

At the present time the sector's enterprises have installed more than 4,000 dust-catching units and apparatus, including 1,220 electric filters and 1,270 bag filters, along with more than 1,500 cyclones and dust-conveying chain-type screens. The bag filters make extensive use of up-to-date synthetic and fiberglass filtering materials. The new SMTs-100 bag filters have been put into operation at a number of plants.

Due to this, every year more than 22 million tons of semi-calcined raw mix, clinker, and cement are caught and put back into the production line.

At most plants special dust-collecting services were created and have been operating fruitfully.

Considerable work on environmental protection lies ahead of us during the 11th Five-Year Plan. It will be necessary to put into operation and modernize 89 electric filters for kilns and 60 dust-purifying units for other equipment, as well as to convert 9 plants to a circulating water supply.

/Improving the economic mechanism/. During the 11th Five-Year Plan in the cement industry, as throughout the country's entire national economy, we will have to introduce a complex of measures to improve and strengthen the influence of the economic mechanism on raising work efficiency and quality, as well as to improve the organizational structure, style and methods of administration.

In connection with this, it is necessary to switch over to using a new system of indicators, which will objectively reflect the end results of production, which will allow fuller consideration to be given to internal reserves, and will facilitate this sector's technical progress.

In order to improve the system of indicators, beginning on 1 January 1982, along with new wholesale prices, an indicator of net (normative) output will be introduced, and it will be followed in computing labor productivity as well as establishing the wage amounts.

At the present time NIItsement has prepared a price list of the norms of net output for all types and brands of cements. Hence, in 1981 we must compute the volume of normative (net) output throughout all enterprises and, on the basis of this indicator, determine the growth of labor productivity and the wage norms for the years 1982--1985.

This year NIItsement must summarize the progressive experience of the brigade form of organization and wages, as well as work out recommendations regarding their introduction at all the enterprises of this sector.

Provisions have been made for a widespread dissemination of the experience of the Sebryakovsk Plant and the Angarsk Combine with regard to introducing a comprehensive system of organizing production, labor, administration, and wages in accordance with

the method of the VAZ /Volga Automotive Plant/. During the 11th Five-Year Plan this method must be introduced, in the first place, at the Mikhaylovtsement PO, as well as at the Rezinsk, Krivoy Rog, and Nev'yansk Plants.

The 26th CPSU Congress determined upon tasks of enormous economic and political importance for the 11th Five-Year Plan. And the cement workers, like the entire Soviet people, having rallied around their native Communist Party, will respond to the decisions of the Congress with self-sacrificing labor, and they will achieve a successful fulfillment of the tasks of the new five-year plan.



2384
CSO: 1821/124

## SHORTCOMINGS IN BUILDING MATERIALS INDUSTRY CITED

Moscow BYULLETEN' STROITEL'NOY TEKHNIKI in Russian No 6, Jun 81 (signed to press 23 Jun 81) pp 11-13

/Article by V. V. Tishenko, chief of USSR Gostroy Subdivision on Standardization in Construction: "On Observing the Requirements of the State Standards for Building Materials, Products, and Structural Components"/

/Text/ USSR Gosstroy, together with Gosgrazhdanstroy, the Gosstroys of the Union republics, ministries, departments, scientific-research and design organizations, in 1980 conducted inspections as to how the requirements of the state standards were being observed at 419 industrial enterprises of the construction industry and the building materials industry under 22 ministries and departments. Analysis of the results of these check-ups has shown that the enterprises are conducting work on improving the quality and plant finishing of structural components, as well as the quality of products, parts, and materials. As a result, at many of the inspected enterprises producing cement, polymer materials (linoleum, tiles, waterproofing), structural glass, ceramic facing tiles, metal structural components, the requirements of the standards are basically being observed.

However, at enterprises producing non-ore-type building materials and lightweight aggregates, reinforced-concrete structural components and products, parts of wooden homes, carpentry and hardware items, asbestos-cement, wall, roofing, waterproofing, and heat-insulation materials, and construction hand tools have serious violations of the standards. This leads to an over-expenditure of building materials and an increase in production costs, to an increase in labor outlays in erecting projects, to a lowering in a number of cases of the reliability and service life of structural components.

Following the results of the check-ups on the output and sale of products which do not meet the requirements of the standards, 42 enterprises were fined, their plan fulfillments were expunged from their records, and 534,200 rubles of profits were transferred to the state budget. At 64 enterprises the sale of non-standard products was temporarily prohibited prior to the elimination of the violations. For example, in checking up on the quality of cement at the Bryansk, Karachayevo-Cherkessk, and Kantsk Plants the facts were established that portland cement had been produced with mineral additives which did not meet the standard requirements with respect to fineness of grind, and at the Kantsk Plant--with respect to flexible strength. Violations of technical parameters were established at most of the inspected cement plants.

At 64 out of 96 inspected enterprises turning out non-ore-type construction materials under a number of ministries and departments violations were established with respect to one or more quality indicators: for grain composition, contents of dust-type and clayey particles, contents in crushed rock of weak rocks and fractured grains in crushed rock from gravel. At a number of quarries there are violations of standards with regard to the size modulus of the sand being shipped out.

For example, at the Sannikovo Quarry of the Vologdasel'stroy Trust of the USSR Minsel'stroy crushed rock is being turned out which is made of gravel, a sand-gravel mix, and enriched sand, which does not measure up to the standard requirements with respect to the contents of dust-type particles and granulometric composition. Technological schedules at all stages of processing raw material have been violated; laboratory control and control of the OTK [Technical Control Department] service have not been organized. Descriptive documents are not issued for the finished output, nor are production certificates produced. A particularly unsatisfactory quality of non-ore-type materials being produced was noted at the Smolensk Combine of the USSR Ministry of Construction, the Petrovsk Quarry of the USSR Ministry of Power and Electrification, the Iskitimsk Plant of the USSR Ministry of Building Materials, the Armavirsk Crushed-Rock Plant of the Ministry of Transport Construction, and the Yermanovsk Quarry of the USSR Minstry of Industrial Construction.

At 118 enterprises the quality of manufacture of precast reinforced-concrete structural components and parts was checked out. Most of these enterprises have turned out products with violations of the standard requirements. At 8 of the inspected enterprises the design brand of the concrete was not being observed with respect to strength; at 20 the thermophysical characteristics of enclosing structural components showed violations; at 100 note was made of the poor-quality manufacture of reinforcement frames, placing parts, their inadmissable placement in the formwork of products or the lack of an anti-corrosion coating. At 80 percent of the inspected enterprises products were being turned out with excess tolerances of geometric dimensions, while 55 enterprises were not observing the regulations pertaining to the receipt, labeling, and storing of structural components.

Thus, at the Samarkand Building-Materials and Structural-Components Combine of USSR Ministry of Construction reinforced-concrete columns, exterior wall panels, and staircases had deviations with regard to geometric sizes, while roofing panels were being turned out with exposure of the reinforcement screens and unacceptable cracks. Anti-corrosion coating of the insertion parts was not being conducted, and the volumetric weight of the keramzit concrete in the exterior wall panels was higher than tolerable. Analogous shortcomings were ascertained at the Baku ZhBI [reinforced-concrete product] Plant No. 7 under the USSR Ministry of Rural Construction, the Vasyurinsk ZhBI Plant under the USSR Ministry of Land Reclamation and Water Resources, ZhBI Plant No. 5 in the town of Tokmak under the USSR Ministry of Construction, the Konakovsk KPD [large-panel housing construction] Plant of the USSR Ministry of Power and Electrification, and the Krasnodarsk KPD Plant under the USSR Ministry of Industrial Construction.

Commissions of USSR Gosstroy applied fines to 17 precast reinforced-concrete enterprises, and 23 were forbidden to sell output which did not measure up to standards.

There are serious violations of standards in the output of wooden structural components and products for construction. Thus, at the Zharkovsk, Novovyatsk, and Vasil'yevsk Combines of the USSR Ministry of the Timber, Pulp and Paper, and Woodworking Industry they are turning out products and parts of wooden houses for rural construction with increased (up to 16--18 percent) moisture of the wood, house parts are not disinfected, window and door units have sags and looseness in the corner connections, while the finished parts have cracks, an unacceptable roughness, splinters, and knots. In the wall panels the heating component is not laid in snugly enough, while the steam insulation does not over over the joints of the parts, and this leads to a freezing of the buildings.

It has been established that not one of the 26 inspected wood-processing enterprises turning out carpentry products fully measures up to the requirements of the standards. Some 30 percent of the carpentry products which were checked out are being made of wood with a moisture content higher than the norm, the strength of the corner connections in 50 percent of the window units is below that required, a portion of the casings are not disinfected, and a glue is used which is not water-resistant. Most of the enterprises do not carry out finishing operations on the products. The accessories for the windows and doors received by the wood-processing enterprises, as a rule, have many defects. The quality is low among the boards and rough-finished products.

Standards have been violated at the Novosibirsk Bol'shevik Plant of the USSR Ministry of Construction, the Chita Combine No. 1 of the USSR Ministry of the Timber, Pulp and Paper, and Wood-Processing Industry, the Chelyabinsk Combine No. 1, as well as the combine in Rostov-on-Don of the Ministry of Construction of Heavy Industry Enterprises of the USSR, the combine in the city of Sergeli under the Ministry of Rural Construction of the Uzbek SSR, and others.

There has been a reduction in the quality of the products being turned out at many of the 13 inspected enterprises of the asbestos-cement industry. Violations of the standard requirements with respect to pipe strength were noted at the Bryansk, Rybinsk, and Spassk Combines under the USSR Ministry of Building Materials. At 4 enterprises individual batches of asbestos-cement sheets did not measure up to the requirements for frost resistance. The Spassk and Ul'yanovsk Combines of the USSR Ministry of Building Materials were prohibited from selling asbestos-cement sheets because of their low flexural strength and violations of geometric dimensions. Violations of technological processes were noted at most of the plants.

Materials derived from the inspections of 16 enterprises producing clay and silicate bricks indicate that the quality and assortment of the items being turned out by them, as before, does not satisfy the requirements of up-to-date construction. What is being turned out primarily consists of solid, low-grade, inefficient bricks with low heat-engineering indicators, having an excess weight of 20 percent. Approximately 25 percent of the bricks do not meet the standard requirements, especially with regard to external appearance, the presence of cracks, splinters, and surface curvature. About 30 percent of the bricks are still being transported in bulk. The Ministries have not adopted the necessary measures to create and produce engineering equipment, modernize, or retool this sector's enterprises.

The check-ups showed that more than half the 21 inspected enterprises engaged in manufacturing hand tools for construction and installation are turning out tools in a limited products list and of a poor quality, which do not measure up to standards or to the approved standard sizes. Most of the inspected batches of tools had an unsatisfactory surface finish, poor-quality coatings by varnish or paint, or unacceptable deviations with respect to geometric sizes. As a result of the inspections, 9 enterprises were prohibited from selling low-quality tools. Fines for selling non-standard tools were imposed on the Volgograd Automotive-Repair Plant of the RSFSR Ministry of Construction and Maintenance of Roads and the Non-Standard Equipment Plant imeni A. Matrosov of the Moscow Gorispolkom.

The principal causes for the production by the construction industry's enterprises of output with violations of the standard requirements and engineering specifications are the insufficient attention and strictness with regard to improving the output quality and, as a result, there are numerous violations of production-technological discipline by the workers of these enterprises. For this reason more than 50 percent of the noted violations were tolerated. At many enterprises the technology which has been adopted is imperfect, low-quality raw materials and component parts are used, wear and unsatisfactory repair of technical equipment and supplies have been noted, there is a low level of organization of initial and operational controls, and the control services are insufficiently supplied with skilled personnel, control-measurement equipment, instruments, and tools.

The results of the check-ups conducted by USSR Gosstroy in 1980 indicate that the enterprises, ministries, and departments ought to adopt more effective measures to improve the quality and plant finish of structural components, products, and materials, to perfect production technology and organization and improve production-technical discipline, to make more extensive use of such forms of work as certification, introduction of comprehensive systems of quality control and material incentives to promote the quality of products being turned out.

Organization at the enterprises of well-targeted work on eliminating the shortcomings which were noted in the course of the investigations with respect to observing the standard requirements will allow us to improve the quality of the building materials, products, and structural components being turned out and to increase the efficiency of their use by means of curtailing the outlays of material resources and labor in construction.



2384
CSO: 1821/124

## USE GLASS INSTEAD OF STEEL FOR INDUSTRIAL PIPELINES

Moscow KRASNAYA ZVEZDA in Russian 6 Aug 80 p 2

/Article by Yu. Utkin: "Glass Instead of Steel"; passages enclosed in slantlines printed in boldface/

[Text] /At the Azot Novomoskovskoye Production Association they have completed installing glass pipelines for sulfuric-acid production. At the present time specialized brigades of the Soyuzsteklomontazh Trust have begun to replace the metal pipes with glass ones at the association's other production lines as well./

One time at a museum in Tbilisi I saw some elegant glass beakers which were smoky-blue in color. It seemed as though they had just come off the assembly-line of a modern-day glass plant. But, in fact, these beakers had lain in the earth...for three thousand years! Time has no power over one of the most ancient and amazingly simple materials--glass.

Corrosion! It is difficult to over-estimate the technical, economic, and social importance of stepping up the struggle against this physical phenomenon. Suffice it to say that at the chemical industry's enterprises alone labor expenditures on anti-corrosion operations comprise 16 percent of all labor expenditures for servicing equipment and pipelines.

But what if the metal is replaced by glass? As we know, it possesses a rare combination of efficient qualities. Moreover, with respect to reserves of natural raw materials and production expenditures, glass competes successfully against all materials, even including plastics.

Specialists at the USSR Ministry of the Construction Materials Industry and the USSR Ministry of Installation and Special Construction Work developed a new type of glass --acid-resistant, heat-resistant, and possessing a high mechanical strength. Then equipment was designed and created for the serial production of pipes, and an All-Union specialized installation organization was instituted; it has mastered industrial methods of installation. In other words, a new branch of the construction industry was born in this country.

During the 9th Five-Year Plan more than 22,000 kilometers of glass pipes were installed in the country's national economy. This allowed us to economize on about 160,000 tons of metal and save more than 430 million rubles! The same trend has been maintained in the 10th Five-Year Plan. And by the end of the 11th Five-Year Plan intentions are to bring the annual production of such pipes up to 12,700 kilometers, or almost double the present year's amount. Because, of course, the sphere within which glass pipes are used is expanding every year. They are utilized not only as engineering pipelines but also as elements of heat-exchange apparatus. Brine-type battery coolers in various storage facilities, heating instruments in hothouses and facilities for growing citrus fruits, air-heaters in boiler units, and other apparatus are successfully operating at the enterprises of 30 different sectors of the national economy.

The introduction of glass air-heaters just at two units of the Karmanovskaya GRES has permitted an annual saving of approximately 8,000 tons of liquid fuel. And these include three echelons using mazut [petroleum-residue-type fuel oil]!

Let's provide another example. At the Ufa Chemical Plant 50 kilometers of functioning glass pipelines have allowed us not only to replace pipes made of stainless steel but even to improve the quality of product output.

Glass pipelines have strode boldly into the food and medicinal industries, they are being used by textile workers to convey various dyes....

However, where the production technology is linked with increased hydraulic pressures specialists have been unwilling to switch to the use of simple glass pipes. The latter need to be strengthened.

This task has been undertaken by the research engineers of the All-Union Scientific Research and Plan-Design Institute for the Comprehensive Planning of the Technology of Installing Enterprises of the Light and Food Industries and Glass Pipelines of the USSR Ministry of Installation and Special Construction Work. Within brief time periods they developed and tested the so-called plated pipes. Serving as plating are such materials as fiberglass, soaked in epoxy resin. The first new pipes were used by the Azot production associations in Novomoskovsk and Minudobreniya in Voskresensk. The results proved to be good. Today more than a hundred kilometers of plated pipes are in operation at many of the country's chemical enterprises.

And so it happened that glass, figuratively speaking, became an outer part of the workclothes.

2384
CSO: 1821/124

UDC 691.327:666.973.2:553/: 691.022-413

# MULTILAYERED CONCRETE INSULATION PANEL DISCUSSED

Yerevan PROMYSHLENNOST ARMENII in Russian No 1, Jan 81 (signed to press 18 Feb 81) pp 49-50

/Article by A. G. Zakaryan, engineer, R. R. Sarkisyan, A. O. Yepoyan, K. O. Karamyan: "Heat-Insulation Perlite-Concrete Slabs as Insert-Linings for Wall Panels"/

/Text/ The use of multilayered panels with a heater layer (heat insulation) is an effective method for reducing the weight and improving the heat-engineering indicators of enclosing structural components. Used as the heater are various lightweight materials, including the following in particular: foam polystyrene, foam concrete, mineral-wool slabs and mats, bituminous perlite, perlite concrete, gas silicate, fibrolit /building material made of processed shavings and portland cement/, and others /1/.

The thickness of the layer of heat insulation is determined in accordance with the required resistance to heat transfer, depending on the temperature gradient and the design coefficient of the material's heat conductivity.

The existing proportional ratio between the coefficient of the material's heat conductivity and its volumetric weight has led to the necessity of using for heat insulation materials which possess low volumetric weights. From this point of view it is most feasible to utilize heaters based on foam plastics (the volumetric weight of some of them is less than 50 kg per cu. m). However, the lack of production of foam plastics in this republic has brought about the necessity of utilizing other types of heaters as well.

Under the conditions of the Armenian SSR, because of the presence of very abundant reserves of perlite raw material, it is feasible to make heaters based on puffed-up perlite sand.

ArmNIISA /Armenian Scientific Research Institute for Construction/ has developed a fine-grained perlite concrete with a complex polymer additive made of carbamide resin and air-attracting substances /2/. The polymer additives being introduced in modest amounts play an active role in altering the rheological properties, the structural formation, and the hardening kinetics of the concretes.

The complex additive is introduced into the cement-perlite mix for the purpose of reducing the volumetric weight of perlite concrete while ensuring the mechanical indicators necessary for heat-insulated products. Furthermore, the use of polymer additives leads to a reduction of water absorption by 20--30 percent and the

coefficient of thermal conductivity by 0.01 k cal/m.hr. °C, an increase in the frost resistance by 10--15 cycles, heat resistance by 100--200° C, and resistance to alternate drying out and humidification by 10--15 percent.

The table cites certain physical-technical properties of fine-grained perlite concretes being proposed for use in enclosing structural components.

ArmNIISA has worked out the technology for making heat-insulation, perlite-concrete insert-linings on pallets /bottom plates/ with removable side-board-forms. Proceeding from the conditions of modulicity, optimum weight and coefficient of thermal conductivity, the dimensions of the inserts are taken to be 40 × 40 × 10 cm. Some 40--100 inserts can be made at the same time on one pallet.

The concrete mix is prepared in forced-action mixers. First the puffed-up perlite sand and cement are fed into the concrete-mixer; after dry-mixing for one minute the water with the chemical additives dissolved in it is added. After mixing for three minutes the prepared concrete mix is delivered to the forming site. Placed within the form, the concrete is vibrated for 30--40 seconds and leveled out; then the side-board-form is removed, and the product on the pallet is transferred to the thermal-processing site. After a 4--6-hour treatment, the product undergoes steaming (in accordance with the following schedule: 2 hours--rise in temperature, 6 hours--isothermic heating at 80--90° C, 1--2 hours--cooling)and then is placed on a rack and dried out by hot air.

Table

| Volumetric Weight in dry state $kg/m^3$ | Strength Limits $kgs/cm^2$ | | Coefficient of Thermal Conductivity kcal/m.hr.° C | Coefficient of Structural Quality |
|---|---|---|---|---|
| | Compression | Flexion | | |
| 400 | 10 | 3 | 0.080 | 250 |
| 450 | 15 | 4 | 0.085 | 333 |
| 500 | 20 | 5 | 0.090 | 400 |

The use of heat-insulation perlite concrete in multilayed wall panels without preliminary drying is not feasible, inasmuch as the excess water, aside from that which is chemically bonded, may remain in the structural component for a long time, worsening its heat-engineering characteristics.

Testing of the technology and the rigging of the insert-linings was conducted at the ArmNIISA experimental area. The test batch (in just this form and by just this technology) was made at the Shinayut Plant. Perlite-concrete heat-insulation panel-inserts were used in making the wall panels at the ArmNIISA experimental area and at Plant No. 7 for making reinforced concrete structural components.

The panel dimensions were 550 × 300 × 24 cm, the volume, with a deduction for the aperture--3.68 $m^3$ (1.03 $m^3$ accounts for the volume of the inserts), the weight after heat

processing was 4.8 tons, in a dry state--4 tons. For the sake of comparison a similar panel with heat insulation made of sacculate perlite was weighed; after steaming its weight amounted to 5.3 tons.

The test use of perlite-concrete insert-slabs as heaters in multilayered wall panels demonstrated their technical and technological effectiveness. Herein the weight of the wall panels is reduced by 20 percent, the heat-engineering indicators are improved, and a cement savings of 6 percent is achieved.

There are future prospects for creating a line to make heat-insulation inserts directly at the plants which turn out wall panels. Subsequently, after production has been set up, the inserts can also find use in the roofs of buildings, heat ducts. etc.

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## ABSTRACT

The technology has been developed for making insert-lining slabs out of perlite-concrete with chemical additives. Under production-line conditions an experimental batch of inserts was made, to be used in mounted wall panels. The insert slabs made of fine-grain perlite concrete in wall panels allow a reduction of 20 percent in the wall weight and savings in cement of as much as 6 percent.



2384
CSO: 1821/124

## GLASS CONCRETE: A NEW BUILDING MATERIAL

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 7 Mar 81 p 2

/Article: "Glass Concrete"/

/Text/ A new building material--glass concrete--has been created at the Central Asian Scientific Research Institute on Irrigation. It has successfully passed tests for strength, flexibility, frost resistance, and has withstood the action of acids.

"Our specialists have replaced the cement in concrete with glass, and the concrete became stronger," states the Institute's director, V. Dukhovnyy.

Resistance to corrosion and destruction have opened up for glass concrete a road to hydro- and land-reclamation construction, particularly in zones where heavily salinized lands have developed. This will enable us to put into agricultural use tens of thousands of hectares of heavily mineralized lands in the Karshinsk, Surkhan-Shcherabadsk, and Dzhizaksk Steppes, as well as in the Kyzylkum Desert.

The output of products made of the new material has been organized at the Fergana Precast Reinforced Concrete Plant.

2384
CSO: 1821/124

METALWORKING EQUIPMENT

## DEPUTY MINISTER REVIEWS RECENT MACHINE-TOOL, TOOLMAKING PROGRESS

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 2, 1981 (signed to press 10 Apr 81) pp 26-32

[Article by Professor Arkadiy Prokopovich, deputy USSR minister of Machine Tool and Tool Building Industry: "Technical Progress in the USSR's Machine-Tool Building"]

[Text]

I

The 10th Five-Year Plan will occupy a worthy place in the history of the heroic affairs of the Soviet people. The USSR advanced considerably in all areas of economic and social development. "The productive forces of Soviet society reached a qualitatively new level," said CPSU Central Committee General Secretary Comrade L. I. Brezhnev at the 26th CPSU Congress. "The scientific and technical revolution is being developed in depth and breadth, changing the face of many production facilities and many branches of the economy."

The machinebuilders and their combat detachment--workers of the machine-tool and toolmaking industry--have made a huge contribution to strengthening the national economy.

Machine-tool manufacturing plays a special role in the country's economic life. It provides the machinebuilding and metalworking industries with the basic industrial equipment (casting, forging, pressworking and metal-cutting equipment), various types of monitoring and measuring tools and instruments, and industrial tooling. It is not by accident that the machine-toolmakers are called the production engineers of machine manufacturing. The technical level and pace of development of all branches of machinebuilding and metalworking depend upon the quality of the product they make and upon its productivity and efficiency.

A most important principle that determines the technical level of modern machinebuilding technology is the degree of utilization of indirect labor, primarily in raw materials, semifinished items, fuel and electricity. Low-waste, energy-conserving technology is a basis for creating new equipment and for organizing machinebuilding production.

The machine-toolmaking industry is a subbranch of many product lines with varying degrees of series output: from small lots, or even single copies of special equipment, to flow-line production of various types of machines and of items for outfitting them.

Common to all types of equipment in the modern era are a growth in operating speeds, a rise in the degree of concentration of industrial processes, a striving to provide for a combining of various industrial operations in a single working assembly, and elimination of the necessity to transfer parts from one unit to another during machining. Therefore, new types of machines are marked, as a rule, by an increased incorporation of multiple tools and of multiple stations. They enable articles to be machined, using several tools simultaneously, and they enable the complete manufacture of articles with the required precision.

The operating loads and temperatures that enable industrial processes to be speeded up also are growing considerably at present. An important factor in raising equipment productivity is an increase in the degree of continuity of operating processes. This is achieved, in particular, by speeding up auxiliary movements and by combining operating processes with loading and unloading processes in time.

The creation of machines that would enable the production cycle to be performed without man's direct participation plays a special role. The next step forward would be the introduction of equipment that would enable operation over a long period of time without man's direct intervention. His role, in this case, would consist in observing normal occurrence of the operating process.

In it characteristic of the modern era that the share of automated equipment is continuously being increased. Integrated automation, including not just the production process directly but also all types of loading and unloading work, the feeding of blanks, the transporting of finished products, and the execution of monitoring and other operations, opens up broad opportunities.

II

A set of measures aimed at supporting scientific and technical progress in machinebuilding and at resolving the tasks set by the 25th CPSU Congress was implemented in the USSR during the 10th Five-Year Plan. During 1976-1980 the output of more than 2,000 types of new, highly productive equipment was mastered, and about 1,000 obsolete models of machinery were taken out of production. New designs for machine tools and installations incorporate the best of domestic and world experience. Of the newly mastered equipment, 96 percent is protected by patents. The productivity of the equipment has been raised an average of 1.3-fold to 1.8-fold. Its reliability and longevity have been increased considerably.

In order to speed up the organization of industrial output and more complete satisfaction of the requirements of various subbranches of machinebuilding and metalworking, new types of articles are being created on the basis of dimensional spreads with deep design unification and with tool ganging. By the start of 1981 the share of equipment that is included in unified product lines reached 50 percent of all the branch's production. More than 65 percent of all the machines manufactured in the branch have been mastered during the last 5 years.

Outstripping growth in the production of equipment for making precision blanks was provided for, in accordance with 25th CPSU Congress decisions. The output of forging, pressworking and casting equipment, for example, almost doubled. The production of automated equipment also was promoted at outstripping rates. During the five-year plan more than 2,000 outfitted automatic lines and about 150,000 specialized automated machine tools were supplied to the national economy. KamAZ

[Kama Motor-Vehicle Plant] alone received thousands of highly productive metal-cutting machine tools, forging, pressworking and casting equipment. Deliveries for the second phase of the motor-vehicle manufacturing giant on the Kama, which went into operation on the eve of the 26th CPSU Congress, grew especially.

Agricultural machinebuilding enterprises also were provided with highly productive automated lines in ever-increasing quantities. The output of equipment with numerical control continues to be developed intensively. During the 10th Five-Year Plan the volume of this output more than doubled. The country is receiving increasing amounts of automated equipment of all industrial categories.

III

New casting equipment is being created, based upon the intensive use of modern equipment that allows extremely accurate molds to be made. Quick-setting chemical mixes are being used on a broad scale in their manufacture. Experience indicates that this problem can be solved with a minimum of expensive materials by means of ordinary metal molds with a sublayer made from synthetic resins. Such two-layer molds justify themselves in practice in the manufacture of a number of fairly complicated articles for machinebuilding on automatic lines. These include crankshafts, camshafts and other items for large-scale production.

So-called flaskfree molding is being developed intensively. Both individual machines and sets of automatic lines that enable costs for the manufacture of tooling to be considerably reduced and the industrial process to be simplified are being created for this purpose. A rise in the quality of castings made of nonferrous alloys, principally of aluminum, is achieved by using low or high pressure methods. This enables high density of structure and precision of geometric shape to be obtained. The output of equipment for precision casting tripled during the last five-year plan.

More than 30 percent of the castings produced in the Soviet Union are now being made by precision casting methods. Their share will also grow in the future.

All types of casting equipment created in recent years are distinguished by greater automation. The output of integrated automatic lines is being increased intensively. Lines for shell molds can be cited as an example. Using them, molds 800x600x-400 mm in size can be made of sand-and-resin mixes. An electronic control system enables tooling to be replaced automatically and molds with diverse industrial parameters to be obtained simultaneously. Productivity of the new automated sets of equipment has been increased 2.5-fold.

Deliveries of outfitted automated equipment to the Pavlodar Tractor Plant, the Altay Motor Plant, Sibsel'mash [Novosibirsk Plant for Agricultural Machinebuilding], the Serp i Molot Plant and many other large enterprises have enabled the output of economical precision castings in the required quantities to be mastered. Productivity has been more than tripled, and the share of such castings in total output has reached 55 percent.

Extremely important for raising the productivity of casting equipment, as is the case with other types of equipment, is improvement of automating equipment through the achievements of modern technology. New models of automatic lines are being built that use electronic systems that enable the industrial process to be

controlled. Because of this, the requirement for expensive large-dimension traditional systems, which are not reliable enough in operation, for path monitoring with contact-type equipment is eliminated.

The use of numerical program control (ChPU) systems is especially effective for the manufacture of equipment for making precision castings out of nonferrous metals. They enable the whole course of the industrial process to be regulated and controlled in integrated fashion.

IV

Pressworking technology development is based primarily upon a considerable increase in the share of sheet-metal stamping and closed-impression die forging in the cold state. This is achieved through multiple-position upsetting machines for manufacturing products of intricate shape at several stations without later mechanical machining. By using such combination machines for producing standardized metal articles (bolts, screws, nuts, pins and so on), the comparatively unreliable large-size automatic lines made up of positioning machines can be dispensed with completely.

A rise in the share of cold deforming has necessitated both the creation of basically new processes that use higher impulse loadings and an increase in the production of rolled metal of higher plasticity.

Methods of advanced enterprises, particularly of the Motor-Vehicle Plant imeni Likhachev, in developing the technology and in mastering equipment that enables blanks with a minimum amount of machining allowances to be produced are being disseminated increasingly widely.

A broad mix of machines and installations for periodic and continuous rolling, and also for fullering, has been created. The production of bearing-metallurgy equipment is being developed intensively.

The use of numerical control systems in forging and pressworking equipment has enabled the work cycle of such machines as punching presses to be automated and a considerable influence to be exerted on the creation of means for mechanizing and automating auxiliary operations, particularly automatic manipulators with numerical control. Today they are becoming an inherent part of industrial equipment for producing forgings.

An important field is the creation of automatic forging complexes with program control, the introduction of which will radically improve the nature of the work.

Program control is being used widely in sheet-metal stamping equipment. The following fact testifies to its effectiveness: one turret punching press replaces up to 10 ordinary sheet-metal stamping presses.

During the last five-year plan the output of highly productive automated forging and pressworking equipment was increased almost 2-fold, automatic lines 1.5-fold, numerically controlled machines 4.5-fold, and machines for making precision blanks more than 2-fold.

V

Primarily the wide use of new types of tool materials, synthetic diamonds and el'bor, which enable cutting to be done at extremely high speeds under rather difficult regimes, has helped to raise metal-cutting machine tool productivity considerably. While in 1971-1975 these materials had been used mainly for abrasive machining, it has now become possible, because of the creation of large polycrystalline tips, to use them widely also for ordinary mechanical machining of hardened steels, hard alloys and other extremely hard materials.

Cutting tools made of polycrystals of el'bor and diamond greatly expand the potential for mechanical machining, and they raise productivity. Multifaceted throwaway sintered-carbide inserts, especially with a multiple-layer hardened coating, possess great advantage. They increase cutting-tool efficiency 2-fold or more, outperform the working speeds, and cut costs for executing auxiliary operations.

As is known, a speed-up of auxiliary motions in modern metal-cutting machine tools is achieved through high-moment drives in combination with a ball circulating screw-nut. An intense rise in the level of automation is common to all types of these machine tools mastered during the 10th Five-Year Plan. This is mostly the result of using modern electronic equipment.

Program control systems are used not just for various types of metal-cutting machine tools. They are also becoming traditional on automatic lines. Thanks to electronic-control systems, which have come to replace relay systems on the various lines that have been put into production recently, the task of automatically monitoring the work of and replacing the cutting tool has been solved and a system for detecting breakdowns of mechanisms has been effected. The reliability and productivity of such lines have been raised considerably.

VI

Along with a sharp increase in the output of machine tools with numerical control, their variety is being expanded continuously. More than 100 models for various industrial purposes have now been created and mastered.

Their technical level has been changed considerably. While in the first stages single-tool, single-position machine tools with program control were manufactured principally, now multiple-position and multiple machines are occupying an increasingly greater share. For comparatively simple operations this problem is solved by building a tool magazine in the form of a turret directly onto the machine tool. Drilling, milling and turning machines in particular are equipped with turrets. In most cases 6-8 positions in these turrets have proved to be adequate in providing for the integrated machining of various articles. Parts that are complicated in configuration (mainly the frame parts of machines) require a large number of tools. Because of this, numerically controlled machine tools that have autonomous tool magazines--so-called machining centers--have been built. They enable not only preselection of the tool that is necessary for machining certain parts but also storage of a set of all the groups of articles that are fastened to a given machine tool. The number of operating positions for such magazines can be 12, 24 or even as many as 120 (for intricate types of machining).

Serial production of numerically controlled multiple-tool machines enable expenditures for auxiliary time to be greatly reduced. Thus, a large NS33F2 model machining center can make parts that weigh up to 250 tons. The weight of the machine tool itself is 400 tons. Another center (model 69B04PMF2), with a tool magazine and turntable, can do integrated five-sided machining of frame parts that weigh up to 300 kilograms. Such multiple-operation machines will be further developed during the 11th Five-Year Plan.

VII

Work connected with automating the loading and unloading of parts is being conducted on a large scale. The job is to make numerically controlled machine tools, like other semiautomatic machine tools, completely automated. The creation of various automatic manipulators with cyclic and numerical control has been called upon to play an important role here. Loading and unloading work can be automated because of them. For instance, an automatic portal manipulator for loading and unloading shaft-type parts that weigh from 1 to 50 kilograms releases three workers. Experience gained in this area is used also to improve other types of machines and equipment.

Experience indicates that numerically controlled machine tools are used more effectively where they have been concentrated in separate sections or in entire production facilities. Engineering services should also be organized for them accordingly.

Technical progress in numerically controlled equipment is associated at present with the creation of systems that have been automated in integrated fashion, which include not only technological progress directly but also the operations of selecting parts and transporting them to workplaces, the planning and organization of production work, accounting for the articles produced, and so on. Intense work has been done for this purpose for some years. Its mission: the introduction of systems that are computer controlled and, where necessary, put autonomous electronic complexes directly at each machine.

Today such sets of equipment for machining body-of-revolution parts and frame parts of various dimensional groups have already gone through adequately broad industrial verification. An initial base for producing such work sections and the equipping of series production machinebuilding branches with them are being developed.

The automated section ASV-20 can be cited as an example. It is intended for the mechanical machining of body-of-revolution parts up to 250 mm in diameter and up to 750 mm long, in small series or in individual production (lathes and milling and drilling machines). It is computer controlled. Productivity in comparison with individual output is raised 4-fold to 6-fold.

VIII

In 1976-1980 much work was done to improve the group structure of metal-cutting machine-tool production. The share of numerically controlled machine tools during the five-year plan increased more than 2-fold, 13-fold during the decade. In 1980 more than 6,000 numerically controlled machine tools were manufactured in the Soviet Union. Twice as many sets of automatic lines were shipped to industry during the five-year plan.

The share of automated and semiautomated machines in total production of metal-cutting machine tools was about 30 percent. In 1980 more than 50 percent of the machinebuilding and metalworking output was manufactured on automated equipment. The output of poorly productive general-purpose machine tools was reduced considerably.

In fulfilling the tasks of the 10th Five-Year Plan, machine-tool builders, like the workers of other machinebuilding branches, achieved considerable success in increasing the effectiveness and quality of production and prepared an appropriate base for still more intensive growth of it. An outstripping pace in the upsurge of machine-tool building is playing an ever-growing role in support of the reequipping and development of various branches of machinebuilding on the required scale.

In machine-tool building, as in all other branches of the USSR's economy, drafts of promising plans have been developed for both the next five-year plan and for a longer period. The general directions for its further development are the creation of basically new and effective methods for machining, and improvement in the design of equipment. This will enable the degree of discreteness of processes to be reduced considerably and the degree of continuity and concentration of processes to be increased. A further rise in the level of automation, founded on the use of the rapidly progressing electrical-equipment and instrumentmaking industries, and also of modern electronics, is of definite significance here.

IX

As noted in "The Main Directions for the Economic and Social Development of the USSR During 1981-1985 and During the Period up to 1990," which was adopted at the 26th CPSU Congress, it is planned to "raise greatly the technical level and improve the quality of equipment and tooling that are being manufactured." During the 11th Five-Year Plan metalworking equipment productivity should be raised 1.3-fold to 1.6-fold. Its precision and durability should be increased considerably.

Experience indicates that only by solving the problems of the technology and design of the equipment and means of automation and of organizational questions in integrated fashion will it be possible to obtain optimal results and greater economic benefit.

According to the specialists' computations, the totality of the factors that determine directly the productivity of the operating machines by using new technology and improving equipment design will provide for about 35-40 percent of the growth in labor productivity. The other 60-65 percent, that is, about two-thirds, should be achieved by a rise in the level of the automation of machinery, the integrated automation of production, and arrangements for the tending of multiple machine tools and of multiple machines. It is here, apparently, that we will also have the main source for raising labor productivity later. Therefore, problems of the integrated automation of production processes are determining factors for the 11th Five-Year Plan and for the period up to 1990.

A further rise in the technical level of machine-tool building and a radical change in the structure of the equipment produced have been advanced to first priority for 1981-1985. The outstripping rate of growth in forging, pressworking and

casting equipment for making precision blanks will be preserved. The production of metal-cutting tools will be developed preferentially through highly productive automated machines, including those numerically controlled, and also through assembly lines and operating sections that are automated in integrated fashion.

X

The Soviet Union's machinebuilding pool now includes about 3 million metal-cutting machine tools and about 1 million items of forging and pressworking equipment. Later, a purely arithmetic buildup of industrial equipment will not solve the problem of increasing the effectiveness of machinebuilding production in the face of extremely limited labor-force resources. Because of this, plans for the new five-year period and for the period up to 1990 call primarily for a rise in the production of numerically controlled equipment and of numerically controlled sections that are automated in integrated fashion. Serialized machinebuilding will be equipped with them, and it will achieve approximately the same level of mechanization and automation as does mass production. As for industries that operate on a large scale, it is proposed to intensify the growth in output of standard integrated automated lines and outfitting equipment for individual industries. This will provide not only for productivity higher than today's but also for a basically new nature of organization of production processes.

New equipment is designed, as a rule, to take into account the potential for manufacturing different like-type parts and for comparatively rapid resetting when it is necessary to change the nature of the production or to modernize or replace the machines being manufactured.

Major problems are to be faced also in the area of raising still more the technical level of cutting tools. For this purpose it is planned to use new grades of materials that will permit cutting-tool speed and efficiency to be raised considerably. Much remains to be done also to establish the centralized production of rapidly resettable automated tooling and to organize automatic manipulators on a broad scale. They will enable integrated automation of processes during all industrial conversions in machine-building production.

Concrete plans for the mastery of new types of highly productive equipment have been defined for all areas of development of the industry, and a foundation for modern equipment is being laid not only for the 11th but also for the 12th Five-Year Plan.

In order to solve successfully the tasks set by the 26th CPSU Congress and to speed up technical progress, machine-tool builders will achieve an organic joining of the scientific and technical revolution with the advantages of the socialist economic system. The traditional systematic ties of the industry's workers with scientists will enable the task of converting to large-scale use of systems of machines and of industrial processes, which will provide for integrated mechanization and automation of machinebuilding production, to be executed successfully.



11409
CSO: 1821/019

FORGING EQUIPMENT PRODUCTION DISCUSSED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 9, Sep 81 (signed to press 6 Aug 81) pp 112-114

[Article by E. Davidyan, general director of Chimkent Production Association to Produce Forging and Pressing Equipment: "From Production Association Development Experience"]

[Text] Our association is specialized to produce forging and pressing machines which are highly efficient and precise and which are equipped with numerical preset control and automatic controls. It has mastered for the first time in our country the production of presses with arc-stator drive, punch presses with numerical preset control, presses for ceramics industry and presses to produce metal-powder parts. Upwards of 15 percent of the association's output is exported to many countries of the world.

During the 10th Five-Year Plan, the lead design bureau (composed of 200 highly skilled engineers and technicians) developed a number of designs for fundamentally new and very complex forging and pressing machines. It produced new technical documentation and modified existing documentation and laboratory-tested forging and pressing machines. The work done was aimed at improving the technical level, reliability, durability and operating features of the machines and reducing their bulk.

Particular attention was paid to developing the production of machine systems and machine complexes permitting the automation and mechanization of labor throughout the technological cycle of manufacturing subassemblies and parts and yielding a good economic impact.

The production of 24 prototypes and 29 reference series of new equipment was mastered and 25 models were replaced by improved versions in the 10th Five-Year Plan. They differed from preceding models in their higher productiveness and greater economy and efficiency of operation. For example, the AB 1922 automatic multistation bolt machine is 30 percent more productive than six units of the equipment it is replacing. Its use will free six workers for other jobs, reduce electric power expenditure by 2,150 rubles per year and save a great deal of metal. As a whole, the economic impact of using this new equipment will be 1,315,000 rubles per year.

A powder metallurgy press permitting the development of practically waste-free technological processes was also developed. The first presses with industrial robots have been mastered and their production will be increased.

According to the control figures for the 11th Five-Year Plan, we will be producing new forging and pressing machines for the first time in this country to produce parts from metal powders, automotive parts in particular. Punch presses with numerical preset control will be modernized for use in electrical engineering and instrument-making branches of industry. The productivity of the new automatic cold upsetters will be 200-300 items per minute. In 1981 alone, the increment in series production will be 12.4 percent.

Implementation of the planned complex of measures will enable us to improve machining precision, durability and reliability of operation in forging and pressing machines 1.4- to 1.6-fold and their productivity 1.4- to 1.5-fold by 1986 (as compared with the level achieved in the 10th Five-Year Plan). Work is being done constantly to standardize machine subassemblies and parts (56 percent are now standardized).

Labor productivity growth is the most important indicator of association economic activity. Various ways of achieving it are being sought. One is the introduction of multipurpose unitized adjustable tools. According to statistical data, tool manufacture comprises 15-20 percent of the net cost of a machine, but the labor-intensiveness of designing and manufacturing attachments is 60-70 percent of the total labor-intensiveness of preparing production. The Chimkent association is basically oriented towards the small- and medium-series production of forging and pressing machines, so it is economically disadvantageous to design and manufacture special attachments for working parts. Under such conditions, a multipurpose unitized adjustable tool is more expedient, and a sector for producing it has been created in the association. Here, a small staff of fitters has produced a sufficient number of mountings -- 39,330 multipurpose unitized attachments. The economic impact is 1,170,000 rubles.

Progressive technological equipment which significantly improves labor productivity has been mastered in many shops. The forging shop operates an electromachining tool for cutting blanks of high-alloy steels; the assembly shops have set up a process for pressing bearings and other very tight parts using liquid nitrogen; the welding shop uses a precision-welding installation, and the machine shops use special machine tools to work complex parts.

A precision casting process has been successfully introduced into production for parts with complex configurations. A special shop with modern equipment was built for this purpose. A large number of parts now go right on to assembly without machining. As a result, the machine tools are freed for other work, output net cost is lower and labor productivity has increased.

As a consequence of the rapid development of modern machine building and continuous improvement in machine designs, items are frequently replaced, resulting in production which is small-series in nature at a majority of machine-building enterprises. Parts are manufactured basically for multipurpose equipment and the work is of a layout and finishing benchwork nature, retarding labor productivity improvement. Given small-series and unit production, the use of automated lines, special and specialized automatic and semiautomatic machines, is limited, since their readjustment is difficult and even impossible, in a number of instances.

At the same time, the problem of reducing the time involved in preparing the production of new items is becoming increasingly critical. All this necessitates working

out and developing new means of automation capable of ensuring a sharp rise in labor productivity in small-series and unit production. In particular, they include special numerical preset control machine tools. Machines with numerical preset control (NPC) were introduced at the Chimkent association in 1970. There were 12 by the end of the Ninth Five-Year Plan and 32 by the end of the 10th. They are basically lathe, mill, boring and drilling machine-tool groups for working the most labor-intensive parts with complex shapes to high precisions. The use of NPC machine tools has ensured a significant labor productivity growth as compared with multipurpose equipment (1.5- to two-fold for the lathe group and two- to three-fold for the milling group) and greatly improves machining quality.

During the past two five-year plans, a certain amount of work has been done on introducing new technological processes. The manufacture of a number of parts has been shifted from a base of rolled ferrous and nonferrous metals to plastics. They do not require additional machining, so labor productivity is higher.

Beginning in 1974, we have been replacing in a planned manner the technological process of grinding hardened parts with the process of turning and reaming them using an "El'bora" cutting edge, which permits using minimum cutting forces and a maximum dimensional stability. At the same time, we achieve linear dimension stability and machined-surface smoothness of class 7-9. Labor productivity increases two- to three-fold when using an "El'bora-R" tool as compared with a hard-alloy tool. Machine tools of higher or high precision which use a rigid SPID [machine tool guiding device] are the most efficient.

We have designed and introduced into production two machine tool units for boring frames of F1730 and FB1732 electromachining presses. Multipurpose equipment is thus freed for other uses.

Output quality remains the pivotal task of the 11th Five-Year Plan. The highest criterion of product quality is certification of the state Badge of Quality. The first Chimkent association forging and pressing machine to receive was produced in 1976, and now 13 press and automatic machine models have been awarded this evaluation, which is 28.6 percent of total output volume. Comprehensive product quality control and production efficiency improvement systems are being introduced. They represent an aggregate of constantly operative, interconnected economic, organizational-technical and social measures reflecting production management functions. The inventor and efficiency-specialist movement has been widely developed. During the 10th Five-Year Plan, 3,970 inventions and efficiency proposals were submitted. The economic impact of using them has been 1,264,000 rubles. Creative groups for introducing new equipment, technology and scientific labor organization participate actively in improving production. As a result, the level of mechanization in basic production had reached 83 percent, and in auxiliary production -- 60 percent, by the start of the 11th Five-Year Plan.

Production retooling, that is, routine renovation, yields a great impact. At our association, the scope and rate of technical progress are determined in significant measure by capital construction done by the direct labor method, along with routine renovation.

Over the past five years, 24,622 $m^2$ of production premises has been put into operation, including 3.3 and 1.6 million rubles worth of construction, respectively, at the association's Lengerskiy and Turkestan forging and pressing equipment plants.

A boiler welding shop and loading platform, a foundry heat-cleaning department, an addition to an assembly shop, an electric power line and other facilities were built. As compared with 1970, production space has increased from 28,000 to 65,000 $m^2$. The increment in production volume due to renovation was obtained basically without increasing the number of industrial-production personnel.

Nearly all renovation measures anticipate social aspects as well. Thus, during the 10th Five-Year Plan, the association built 10,847 $m^2$ of housing, improved housing conditions for 687 families and opened kindergartens and day nurseries with spaces for 200 children. In the 11th Five-Year Plan, we intend to build 12,000 $m^2$ of housing, a Machine Builders House of Culture for 600 people in 1982 and a kindergarten center for 280 children in 1983. The demand for space in children's institutions will be almost fully met.

We plan to improve medical services by building a treatment facility for 80 people at a Pioneer camp in 1983; in the winter, it will be used as a health resort and recreation center for adults, and in the summer it will be for the children.

Renovation and capital construction have required intensifying personnel occupational training. The association regularly recertifies engineering-technical workers, enabling us to approach the shaping of a supervisory promotion reserve objectively. Particular attention is paid to improving worker skills. Their training is organized around servicing several machine tools, and the training is done following a scientific labor organization plan.

All types of study are closely connected with association practical tasks. In the 1980-1981 academic year, about 2,000 workers were studying in the economic education system and in schools of communist labor, where an important place is given to the study and planned dissemination of leading experience. The system of tutelage of young people is widely developed. A tutor is assigned to each new worker (many of whom are secondary school graduates). And a basic point in their personal socialist obligations is to have the young workers achieve the goals of their own tutors.

Chimkent association still has quite a few unused reserves for increasing labor productivity, foremost among which is improving technical rate-setting, the economical use of materials, expanding the amount of machine-tool equipment available and introducing new technological processes. But we are not in a position to solve some of the problems which have arisen through our own efforts alone.

The Ministry of Machine Tool and Tool Building Industry allocates each year fewer funds for updating the machine-tool fleet than is anticipated by the retooling plan. Difficulties have arisen in the direct-labor construction of lower-limit projects, which are run by the association's repair-construction administration. Inasmuch as USSR Gossnab organizations do not supply it with component sets, it is hard to obtain building materials and reinforced concrete items locally. We are let down by suppliers of metal, lumber and electrical equipment. The procedure for drawing up technical documentation for forging and pressing machines is complicated, especially for approving specifications and technical level charts. It is within the authority of superior organizations -- USSR State Standards Committee, USSR Gossnab, ministries and departments -- to solve these problems.

The association collective is doing everything possible to increase production efficiency, raise the technical level of its output and improve its quality, reliability and durability. The guarantee of this is the mobilization of unused reserves, improving production and labor organization, introducing progressive technologies and retooling.



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CSO: 1821/016

## EXPORT MACHINERY, EQUIPMENT QUALITY SCORED

Moscow TRUD in Russian 24 Jul 81 p 2

[Article by Lenin Prize winner and USSR Deputy Minister of Foreign Trade N. Smelyakov: "Demand Also Depends On Supply"]

/Text/ Very long ago it was said of trade that it unites peoples and countries. And probably it was observed just as long ago that trade--especially foreign trade--develops successfully when a commodity can stand up for itself, so to speak, and when one party wishes to buy it as much as the other wishes to sell it.

Remembering that the very closest and most direct bond exists between production achievements and trade successes, let's see how thing stands with exports of our machinery and equipment. The first thing we encounter is the high rate of growth in such exports, from 3.8 billion rubles in the Seventh Five-Year Plan to 23 billion in the 10th. More than 100 countries buy our products. I am pleased to note that some of those products are the equal of or are even superior to similar products being produced by our competitors -- the Niva passenger car, the IL-76 aircraft and MI-8 helicopter, the Baltika ore carrier, cold-rolling pipe mills, a group of boring machines, and others. The fact is that on the world machinery and equipment market we are encountering very, very serious competition, and we can come out on top only if, as L. I. Brezhnev stated at the 26th CPSU Congress, the level of product quality standards is the very highest. Further, "We cannot and must not agree to anything less than conformity to the best world and domestic models. We must accustom ourselves to this and must achieve a situation in which we resolutely discard everything obsolete, backward, everything whose value has been discounted by life itself."

This is the only fair way to pose this problem. In spite of substantial successes, exporting machinery and equipment labeled "Made in USSR" leaves much to be desired. True, more than 100 countries buy our products. But Soviet machinery and equipment accounts for only 4.4 percent of all exports by the developed capitalist countries. True, people are glad to buy the Niva. At the same time, a significant amount of our machinery and equipment is insufficiently competitive, not only in the capitalist market, but also in socialist countries, where our goods encounter others supplied from capitalist countries.

It is foremost a matter of our industry's sometimes lagging behind the rates of scientific and technical progress and, as a result, not being in a position to meet the demands of the foreign market. Here are several examples.

It is a fact that diesel engines are much more economical than gasoline-powered engines. Were 65 percent of our trucks and 20 percent of our passenger cars equipped with diesel engines, we could save 10 million tons of fuel a year. At the same time, this year only 19 percent of the trucks produced by our industry will be equipped with diesels, and passenger cars are still waiting their turn. For comparison: in other countries, diesel trucks comprise 30-60 percent of the vehicle fleet. The proportion of passenger cars with diesel engines is rising constantly. Sad to say, domestic diesel engines (even the Badge of Quality model made by Yaroslavl' Engine Plant) are seriously inferior to similar foreign models.

The stretcher-straightener made by "Uralmash" weighs 2,800 tons. The exact same British or West German machine weighs 1,100 tons: two and a half times lighter! Why? Because instead of cast steel, we use alloy steel and forgings. And finally, grain combines. In recent years, the very latest domestic and foreign machines have been tested in various climatic zones of the country. The results were distressing to us: the foreign units were better in all basic indicators -- productivity, reliability, combine operator working conditions, grain losses.

Particular attention should be paid to the poor quality of ferrous metals used in machinery production. The mechanical strength of steel here is about 50 $kg/mm^2$. That indicator is higher among our competitors -- 75 to 90 $kg/mm^2$, and a FRG automobile company plans to increase the strength of its metal to 125 $kg/mm^2$ in the near future. Its automobiles will consequently weigh much less and their economic efficiency will improve correspondingly.

This unhappy list could be continued, but now let's try to analyze the causes of this situation. Without pretending to make an exhaustive analysis, let me note that improper, unobjective evaluation of the technical level of the output produced by our industry is an important hindrance. Improper evaluation leads to mistaken conclusions which, in turn, are fraught with wrong decisions. What sort of unobjective evaluation am I referring to? I could cite more than one enterprise, whole ministries, in fact, which overstate the technical level of their products in their reports. Sometimes the difference in evaluations of technical levels by foreign trade organizations and that represented in the reports is two- or three-fold. All is well until this output begins competing with similar items being produced abroad. The winner then is the one which has in fact achieved better quality. The extremely insignificant volumes of exports of our machine-building output to the developed capitalist countries and so substantial a difference in evaluations of the technical level of domestic machinery and equipment should certainly have attracted great attention in the country's Gosplan and State Standards Committee and have alarmed them and aroused them to action. However, that has not happened.

Further. We could substantially raise the level of domestic output were more extensive use to be made of accumulated world scientific and technical experience. We are currently purchasing and using entirely too few foreign licenses for design and production technology. Citing Japan as a very vivid example of the doubtless advantages of using licenses acquired from abroad has now become commonplace. And we, too, have positive experience in this area. Some 380 licenses were purchased for the VAZ automotive plant, and pressing their use saved time and moved things forward quickly. At the Bryansk plant, licenses were utilized for ship diesels, which not only solved the problem within the country, but enabled us to develop exports. But still, there is every basis for maintaining that, although our industry is gradually

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All this indicates that we are inclined to underestimate foreign experience. Here is a typical example of this attitude. Our industry has been trying to develop (unsuccessfully so far, alas) a 330 h.p. tractor for more than 10 years. At the same time, Caterpillar Company of America has been producing such machines for more than a quarter of a century, and Kamotsu Company of Japan exhibited this year a bulldozer based on a 1,000-h.p. tractor! It would seem there is something to learn from someone else here, someone from whom to buy a license in order to master production and set it up quickly. In fact, that is exactly what automobile builders here -- referring to that same VAZ automobile plant -- have done proving for the n-th time that the creative borrowing of another's experience in no way deprecates the value of a nation, but to the contrary, testifies to its wisdom. Since 1972, the Ministry of Foreign Trade has suggested that organizations concerned solve the problem of producing industrial tractors on the basis of licensing agreements with the leading companies in this field. However, it was decided to do this only this year. Talks are now underway, but the time lost cannot be regained and nine years lost will be on the conscience of those whose morbid pride and conceit have cost our state so dearly.

Unfortunately, even the licenses acquired are often used extremely slowly. Ten years ago, a license to produce gas motor compressors for petroleum and gas industry was purchased for "Dvigatel' Revolyutsii" plant (Ministry of Machine Building for Heavy Industry Enterprises). That production has not been mastered yet. "Russkiy Dizel'" plant (same ministry) has been setting up the release of five models of so-called medium-rpm diesels for seven years (licenses acquired in 1973). In the intervening years, several dozen engines of just one model have been manufactured, whereas they should have been manufacturing several types, and many times more of them to boot.

And the rapid practical use of scientific discoveries is a characteristic feature of our times.

The servicing of machinery is of enormous importance in improving its ability to compete. This problem has not yet been properly solved.

At the same time, the most diverse countries, often thousands of kilometers apart, have large numbers of Soviet-produced machines today. More than four million automobiles alone, for example, more than half a million tractors, nearly 40,000 excavators, and so on. The armada of machines a customer has is a dictator, not a pitiful petitioner of spare parts. It is time our machine builders fix this rule firmly in their minds; it is, in fact, accepted in international practice. It is time we master the following principles of technical service -- the producer services; spare parts are supplied so long as a single machine is running; all customer orders are met first, in terms of products list, quantity and delivery schedules, even if spare parts must be taken off the main conveyor to do it.

Service technology is a whole science, which our competitors have developed extensively. We should immediately create it as well, as the lack of it is costing the state dearly.

Exports are often likened to the calling card of a country which supplies goods to other countries. It seems to me that exports are a record book in which grades are recorded by the mercilessly strict examiner that the world market is.

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4 Dec 1981